Modeling and Simulation (M&S) Use in the Army Acquisition Process

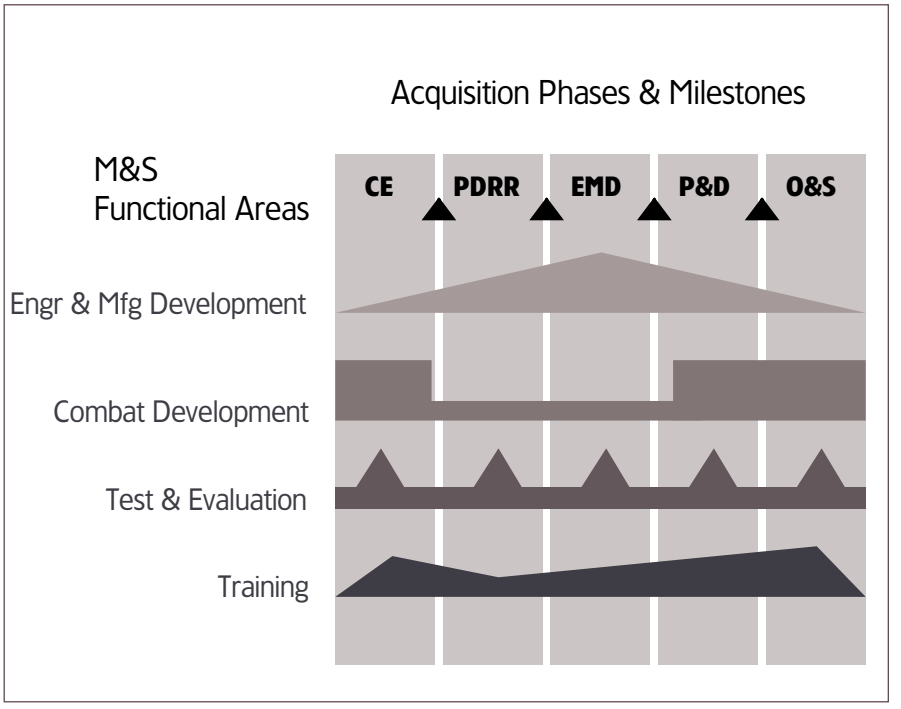
Shift to Simulation Based Acquisition Recognizes M&S As Tremendous Opportunity for PMs

DR. HERBERT K. FALLIN, JR.

A new paradigm is emerging in the Army regarding the use of Modeling and Simulation (M&S) in the acquisition process. This new paradigm is Simulation Based Acquisition (SBA). Under the old school of thought, M&S was regarded as just another tool to be used in the design of a weapon system. The shift to SBA recognizes that M&S represents tremendous opportunity for the program manager (PM) and is more than just a tool to be taken for granted. PMs today recognize that M&S must be managed as a resource in order to achieve the benefits inherent in the use of M&S throughout the acquisition process. In order to capitalize on these benefits, PMs must be savvy in two critical areas:

- What is SBA?
- Just how it is implemented?

Figure 1. **What is Simulation Based Acquisition?**



The use of M&S in the acquisition process is nothing new to the Army. What is new is the increasing availability and power of M&S tools and the decreased availability of resources for weapon system development. These two occurrences have served as a forcing function, steering the acquisition community into better integrating the use of M&S throughout all phases of the acquisition cycle, to ultimately deliver fielded systems within imposed budget constraints. When properly incorporated into a program, SBA yields the following benefits, which act to reduce risk in cost, schedule, and performance:

- Continuous evaluation of system development.
- Rapid evaluation of concept design.
- Reduce and delay need for physical prototype.
- Facilitate continuous user participation in development process.
- Efficient development/evaluation of manufacturing plans.
- Reuse of system software and hardware in training simulators.
- Ability to test proposed system at sub-component, component, and system level.

Fallin is the Director, Assessment and Evaluation, Office of the Assistant Secretary of the Army (Research, Development, and Acquisition). He holds a B.A. in Mathematics–Physics–Education from Western Maryland College; an M.A. in Mathematics from West Virginia University; and a Doctorate in Statistics from the University of Delaware. He is a an adjunct full professor at American University; a graduate of the Federal Executive Institute; and a graduate of the John F. Kennedy School of Government. Prior to his return to the Pentagon in 1993, Fallin was the Scientific Advisor to the Supreme Allied Commander Europe (SACEUR) at Supreme Headquarters Allied Powers Europe (SHAPE) in Mons, Belgium. Fallin is a 1995 Presidential Meritorious Executive.

What Is Simulation Based Acquisition?

SBA is a concept for efficiently managing M&S as a resource to be exploited by the PM in the effort to accomplish acquisition objectives. As we shift toward more efficient and effective use of M&S, the abandonment of "stovepiping" techniques for employing M&S must become a reality. The boundaries imposed by the acquisition phases and milestones are no longer constraints to those who optimize the use of M&S. Re-use of M&S for multiple functions and linking different models and simulations across all phases of acquisition is a powerful concept with benefits that are currently being realized. SBA is characterized by a more flexible and integrated approach to using M&S in the acquisition process.

As depicted in Figure 1, the utility of the SBA concept to the PM lies in the notion that M&S developed for use in a functional area can serve in a similar capacity to accomplish tasks in each of the phases, from concept exploration to operations and support (O&S). Usually the M&S evolves as the program progresses until a full suite of models evolves, which represents the entire weapon system. Linking models together using one model's output data as input data for another model generates efficiencies for the PM that allow reductions in cost and schedule.

Identifying how M&S can be used across the acquisition phases and in the various functional areas represents the first step in developing the Simulation Support Strategy. This strategy focuses on the appropriate mix, type, and fidelity of M&S tools. One of the largest barriers to the effective execution of the Simulation Support Strategy in the Army was the inability to clearly articulate M&S requirements to those responsible for the actual development of M&S. To rectify this problem, the Simulation Support Plan (SSP) Guidelines, which are discussed later in this article, were introduced. These guidelines require Army PMs to craft a Simulation Support Strategy and package this strategy in a format that clearly identifies and communicates M&S requirements to the modeling community – a format referred to as the "M&S Tool Kit."

Figure 2 illustrates the mapping of M&S tools to M&S requirements. This is the essence of the SSP.

How To Incorporate SBA

The SSP is the implementing tool the Army uses to employ M&S in the most effective and efficient manner possible. This construct was initiated in 1993 by the Military Deputy to the Army Acquisition Executive. In 1996, OSD implemented a policy that required all ACAT I and II programs to coordinate their SSPs with various Army activities and include an M&S strategy summary in the Acquisition Strategy Report. The SSP Guidelines, published and distributed in May 1997, further supplemented this guidance. Additionally, in his May 2, 1997, memorandum, the Principal Deputy to the Under Secretary of Defense for Acquisition and Technology encouraged all the Services to use the Army's SSP Guidelines as a model for PMs to organize their respective M&S strategies and implement SBA.

The intent of the SSP is to provide a management tool that assists the PM in thinking through M&S requirements for the acquisition program. Additionally, the SSP provides visibility of M&S capabilities to not only the PM and supporting communities, but to other system PMs and programs in other Services. Such visibility promotes possible re-use of M&S.

The SSP, when properly crafted, conveys more than just what M&S is being used to support the program. It provides a road map to the PM, and the acquisition community, which indicates what types of M&S are required and when the M&S is needed to meet program objectives. The SSP is the vehicle that allows the PM to thoroughly integrate the use of M&S into the acquisition strategy. Figure 3 shows how the SSP road map ties in directly with the acquisition strategy.

Figure 2. **Generic Top-Down Level Representation of an SSP**

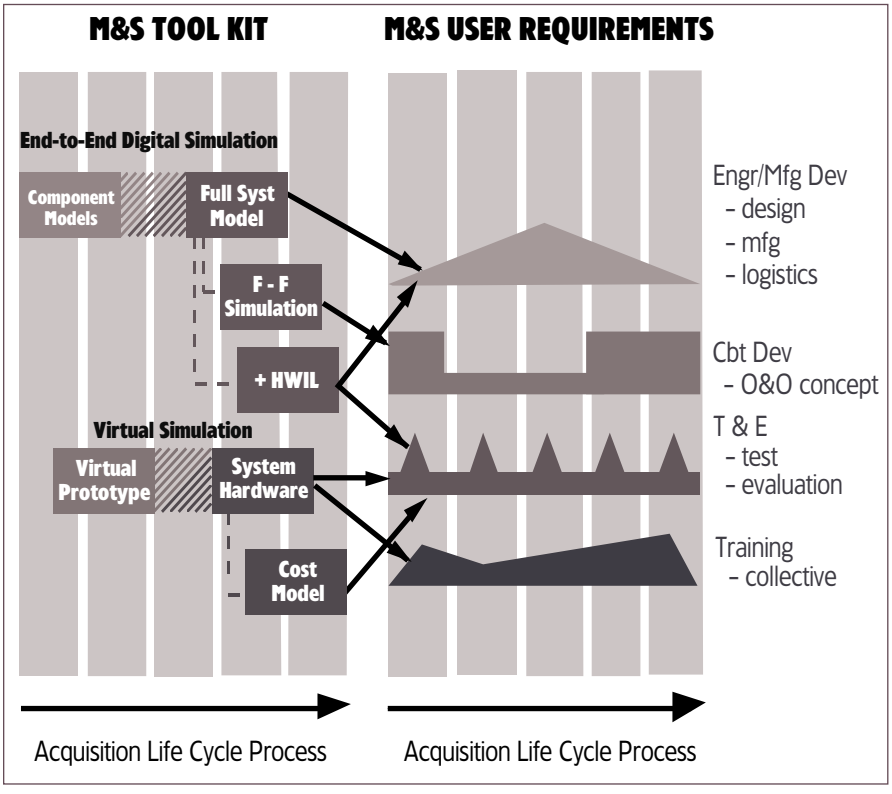
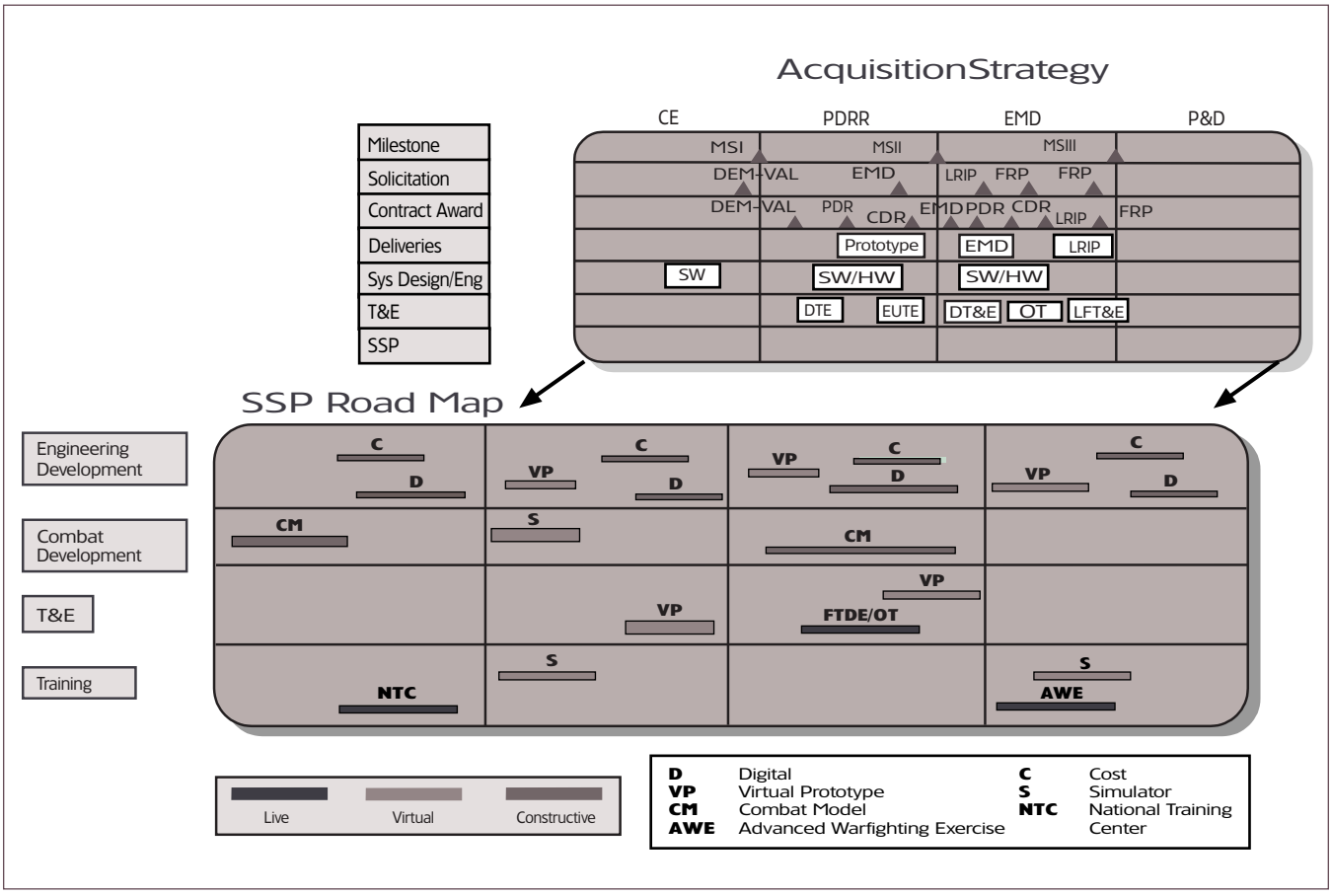


Figure 3. **SSP "Road Map" Integration with Acquisition Strategy**



As indicated in the figure, the use of M&S in the functional areas occurs across all of the acquisition phases.

Just as the PM develops an acquisition strategy for the desired system, so too must the PM develop a strategy for M&S. The SSP indicates not only what M&S is required to support system acquisition, but also when the M&S should be available for use, and when and how verification, validation, and accreditation (VV&A) will be performed.

The concept of managing M&S as a resource is not always readily obvious. Typically, tools are not thought of as requiring management attention. Because of the tremendous capability of M&S to reduce cost and schedule as well as mitigate associated risk, the PM who does not actively manage M&S activities risks fielding a system that is over budget and behind schedule.

A helpful analogy in understanding why it is important to manage M&S tools is to think in terms of a do-it-yourself home project (such as building a set of storage cabinets). Anyone who has ever embarked on such a venture has a full appreciation of why the proper tools are so important. With the right tool, a daunting task can become easy. Prior to starting that home project, a set of plans is needed along with a list of required materials. The mistake many first time do-it-yourselfer's make is not realizing it is just as important to have a plan for how to use the needed tools and when to have them available. Because this is so often overlooked, time is frequently lost because the right type of tool was unavailable when needed. Work has to be interrupted to fetch the needed tool. In some cases, if prior thought had gone into identifying the best type of tool for a job (a sliding compound miter saw instead of a circular saw for instance), the job could have been accomplished in not only less time, but also with less effort and cost.

The same holds true for M&S. A PM who takes the time to identify the best set of M&S tools that can be used to accomplish needed tasks will ultimately field a better product. M&S can be used to augment the systems developers' capabilities. M&S provides the means for conducting "what if" drills when exploring new concepts or stressing a system's performance. It can also be used to identify design flaws, thus reducing and delaying the need for a physical prototype. M&S facilitates user participation in the design process so that the fielded system has increased quality, military utility, and supportability. A PM who develops and implements a well thought-out M&S strategy will end up with an improved acquisition strategy as well as a superior product in the field.